XXIV. *Synepigonic series of* Papilio cenea (1902–3) *and* Hypolimnas misippus (1904), *together with observations on the life-history of the former.*

By George F. Leigh, F.E.S. With notes by Professor Edward B. Poulton, D.Sc., F.R.S., and an Appendix by Roland Trimen, M.A., F.R.S.

[Read June 1st, 1904.]

Plates XXXI and XXXII.

I. *Observations on the life-history of* Papilio cenea.

On September 18, 1902, I took a male of *Papilio cenea* in copulâ with a female of the *cenea* form which is commonest in Natal, viz. that which possesses *white* spots on the fore-wing. Having previously discovered the food-plant, I decided to try and obtain eggs. I placed in a large paraffin tin a small example of this plant, and by its side a vase with several of the flowers on which the butterfly feeds, covering all in with mosquito netting. The female *cenea* fed on the flowers, and lived for five days. I then carefully examined the plant and found 90 eggs upon it, but not one on the flowers or the sides of the tin. The eggs are white and very small; they are laid upon both sides of the leaves and upon the small stems of the food-plant. The larvæ began to hatch on September 29, only three of the eggs proving barren. The young larvæ are nearly black in colour, with white on the last segment. The first ecdysis occurred on October 3–5, when 13 of the larvæ died. They were then transferred to another tin with fresh food-plant. In the second stage they are chocolate and white. When not feeding, the larva rests upon a slight web spun over the central part of the leaf. The second ecdysis occurred on October 8–11, after which 70 living larvæ were counted. The colours were as in the second stage, save that the chocolate was of a paler shade. The larvæ fed well and grew rapidly, the third ecdysis taking place on October 13–16. An immense change in appearance is now manifest; for the larvæ of the fourth stage are blue-green, beautifully variegated with white, of which the amount varies greatly in different individuals. All the larvæ passed this ecdysis safely, but four were killed for preservation. The last ecdysis occurred between

October 18 and 26, some of the larvæ lagging behind the others in their rate of growth. Another change is now witnessed; for the larvæ of the last stage are blue-green (exactly matching the food-plant), with small orange spiracular spots and two blue spots invariably present on the third segment, other segments being sometimes similarly marked.

The larvæ began to attach themselves preparatory to pupation on October 27, and continued to mature for about a fortnight. The situation generally selected was a part of the food-plant where a leaf had been eaten completely away; although some pupated upon the netting and some upon the sides of the tin. Six larvæ were killed for preservation, and a certain number failed to pupate; but I obtained 56 healthy chrysalides, all of which were green, exactly matching the shade of the leaves of the food-plant.

The imagines began to emerge November 7, and continued to come out up to the 22nd.

It is often stated that the males of Lepidoptera tend to emerge before the females, a conclusion which my experience by no means confirms. In this case the first two which emerged were both females. I did not keep an account of the emergences after this, but the largest number to appear in one day was 11, of which 7 were females. According to my usual experience with bred specimens there were a larger number of females than males, viz. 27 to 18. The 11 remaining pupæ either dried up or produced cripples.*

All the specimens were smaller than those of the same broods captured in the wild state, and this I trace to the artificial conditions inseparable from the described method of breeding.

In nature the females are far rarer than the males; one might probably see twenty-five of the latter to one of the former. The female, I believe, flies but little in the open except when engaged in oviposition. Only two or three eggs are laid on each plant, and those growing under trees or otherwise in the shade are the most frequented. The

* In future work of this kind when the material bears upon problems in heredity of the utmost importance and complexity, every dead pupa and every crippled specimen should be carefully preserved; for the lens would certainly reveal the sex, while dissection would in many cases reveal the variety.—E. B. P.

larvæ are invariably found on the lower parts of the plant, as near to the ground as possible. They are fairly easy to detect in the chocolate and white stages, but in the last they are the hardest larvæ to find of any with which I am acquainted. The method which I have found to be the best is to knock the plant with the hand, when the disturbed larvæ evert their crimson prothoracic scent-glands. They are then either seen or their presence is revealed by the smell. The pupæ are even harder to find than the larvæ.

My experience with the rare *trophonius* form, mimicking *Limnas chrysippus*, is somewhat limited, but I have succeeded in breeding four examples from captured wild larvæ. I have observed that its pupæ are quite different in colour from those of the other forms. With this exception, the pupæ of all the varieties of *cenea* are simply green, and do not vary in appearance, like those of many of the *Papilioninæ*. The pupa of the *trophonius* form of female was at once distinguished, in the examples which have come under my notice, by a number of brown lateral markings. Of course I am not referring to the usual changes before emergence, when the pattern of the wing can be recognized beneath the thin pupal cuticle, and when, in the case of *cenea*, the male can be easily distinguished from the female.

II. *The Syncpigonic Group bred in* 1902 *from a pair of* Papilio cenea (cenea *form of female*).

It has been already stated that 27 females and 18 males were bred from the parents represented on Plate XXXI, Figs. 1 and 2.

A. *The Female Offspring.*

Not a single example of the brown *trophonius* form, mimetic of *Limnas chrysippus*, appeared among the 27 females, but three were of the *hippocoonoides* form (two of these are represented in Plate XXXI, Figs. 7 and 8) mimicking *Amauris dominicanus*. All the rest were the *cenea* form (four of these are represented in Plate XXXI, Figs. 3–6) mimicking *Amauris echeria*. Of the *cenea* forms three possessed buff-coloured spots on the fore-wing; while probably the whole of the remaining specimens, 21 in number, were the variety which is commonest in Natal, and possesses white spots on the fore-wing, mimicking

A. albomaculata and the examples of *A. ecberia* which converge towards it. Two or three cripples were liberated, but they were certainly *cenea* forms, probably white-spotted.

I feel confident that no wild eggs or larvæ were accidentally introduced with the food-plant, but cannot be equally sure about the pupæ. I was not then very familiar with these remarkably cryptic forms, and it is possible that one, or even two or three, may have slipped in unperceived.

Comparison of the Individuals of the 1902 *Synepigonic Group of* Papilio cenea. By E. B. Poulton.

A considerable part of the 1902 material had been dispersed before the present paper was written; but I have made a careful examination and comparison of the whole of the remaining specimens recently presented to the Hope Department by Mr. Leigh. These consist of 8 females (6 *cenea* forms and 2 *hippocoonoides* forms) and 6 males. In the first place it appears possible that the presence of one male and two female (white-spotted Natal *cenea* forms) specimens, which are distinctly larger than the others and also larger than the parents of the group, may perhaps be accounted for by the accidental introduction of wild pupæ with the food-plant.

When the 6 females of the *cenea* form were minutely compared it was apparent that they are not divided into two distinct categories respectively characterized by the buff tint and by the white appearance of the five chief spots of the fore-wing. There was, on the other hand, the most perfect gradation of the one form into the other.

The five chief spots may be indicated by numbers as follows:—

(1) The largest spot, of an oval form, placed below the cell, between the 1st and 2nd median nervules.

(2) A spot, of which the form is usually oval, placed beyond the end of the cell, between the 2nd radial and 3rd median nervules.

(3) A roundish or oval spot, placed beyond the end of the cell, between the 5th sub-costal and 1st radial nervules.

(4) A roundish or oval spot, with its outer border generally marked by a concavity. When the latter curve is strongly marked the spot becomes crescentic (as in Plate XXXI. Fig. 4) or reniform (as in Fig. 3). This spot

is placed beyond the end of the cell, between the 3rd and 4th sub-costal nervules.

(5) The irregular spot within the cell.

The transition from a condition, resembling the female parent, in which the five chief spots of the fore-wing are white, towards one in which they are buff, is clearly seen in the following comparison of the 6 female specimens in this synepigonic group.

I. The largest specimen, unfigured. All five spots white except the edges of (1). The buff tint is especially pronounced on its inner marginal edge —a tendency often manifest in specimens in which this spot is almost entirely white.

II. A slightly smaller specimen, unfigured. (1) *very* pale buff, (3) still paler. The latter not uniformly tinted. At a little distance both spots appear to be white.

III. The specimen represented on Plate XXXI, Fig. 3. (1) distinct buff, (3) and (5) *very* pale buff, the tint of (3) being even fainter than in the specimen last mentioned. At a little distance all spots except (1) appear to be white.

IV. The dwarfed specimen represented in Fig. 5. The condition is similar to that described in No. III, except that spot (3) is of a very slightly deeper shade. Nevertheless, at a little distance all the spots appear to be white except (1).

V. The specimen represented in Fig. 4. (1) buff of a slightly deeper shade than in specimen No. III. (3) very distinct buff. (5) outer half of the area distinct buff. The lens shows traces of the same tint on (2) and (4), but to the eye these two spots and the costal (or inner) half of (5) appear to be white.

VI. The much-dwarfed specimen represented in Fig. 6 All spots except (4) buff, with an appearance of additional depth of tint caused by the over-spreading of dark scales—an encroachment of the ground-colour of the wing. (4) appears to be white or *very* pale buff at a little distance, and is much less overspread than the others. The depth of the shade of buff is most marked in (1), then in (2), (5), and (3) in this order.

The dwarfed condition of specimens 4 and 6 is worthy

of attention, inasmuch as it is possible that the shock of abnormal conditions may have favoured slight reversion to a relatively ancestral form. It has been similarly observed that a set of abnormally small specimens of *Limnas chrysippus*, var. *dorippus* (= *klugii*), from Machakos Road, British East Africa, exhibited an unusual amount of reversion towards the type form of the species (Trans. Ent. Soc., 1902, p. 483).

The very distinct di- and trimorphic forms of some of the chief Ethiopian mimics of *Limnas chrysippus* are still connected by transitional varieties which have been lost or are at any rate unrepresented in the primary model. Hence it has been argued that "*A Study of Mimetic Forms may enable us to reconstruct the Lost Stages through which the Older Model has passed*" (Trans. Ent. Soc., 1902, p. 482). In this case also it is seen that uninterrupted transition obtains between the *cenea* forms of the female mimic with white spots on the fore-wing and those with buff. In the Danaine models, on the other hand, there is a sharp break between the white-spotted *Amauris albomaculata* and the buff-spotted forms of *A. echeria*, and even between the white and the buff varieties of the latter species. It is in every way probable that here too the transition which is witnessed in the younger mimic formerly existed, but has finally disappeared in the older model—viz. the two forms of *Amauris echeria*. As regards the origin and history of the differences between the two *species* which act as models—viz. *albomaculata* and *echeria* —the interpretation is at present less clear and convincing.

It is unnecessary to describe the two *hippocoonoides* forms of females. A glance at Plate XXXI, Figs. 7 and 8, will show that the pattern is typical, although the size is abnormally small, especially in one specimen (Fig. 7).

A careful comparison of the male individuals in the 1902 synepigonic group leads to equally interesting results. In this investigation I have confined my attention to the most distinctive feature of the pattern—the inner black band of the hind-wing. It will be seen that this marking is subject to remarkable individual variation in males of one family. At the same time it is the character by which the males of certain forms of the *Papilio dardanus* (*merope*) group are usually discriminated. It will be convenient to describe the appearance of the band in the best-known forms, before proceeding to record

the individual differences between the males of a single family of the same form.

The inner row of black patches on the hind-wing of the ancestral *Papilio meriones* from Madagascar is usually broken by two gaps, one between the 2nd sub-costal and the discoidal nervule, the other between the 2nd and 3rd median nervules. The former may be conveniently spoken of as "the costal gap," the latter as "the inner gap." The costal gap is often partially and sometimes completely closed by a sickle-shaped black marking, with its concavity directed inwards. The broadened base of this marking, present in all the specimens I have examined, arises from the black patch placed between the discoidal and 3rd median nervules. The inner gap is often partially filled by a detached black spot. This description applies to females as well as to males, although the black markings are more often developed and tend to be more completely developed in the gaps of the first-named sex.

The male of *P. dardanus* (= *meropc*) from the West, or rather the tropical forest (for it extends at least to the N.-E. shores of the Victoria Nyanza), is very similar to that of *meriones* in the characters here described; but the gaps are on the whole wider and less frequently occupied by spots. The base of the sickle-shaped marking is, however, generally present. In the male of *P. antinorii*, from Abyssinia, the band is even more interrupted than in *merope*.

In the male of the Eastern and Southern *P. cenea* both gaps are usually filled, and a continuous broad black band extends from the inner to the costal margin, nearly parallel with the general trend of the hind-margin. This band, which is by far the most prominent feature of the hind-wing, tends to reach a fuller development in males from the northern section of the insect's range along the Eastern coast as compared with males from the southern section. Nevertheless, even in the specimens with the heaviest markings the position of the inner gap is clearly indicated by a bay on the hind marginal border, rendering the band narrowest at this point. Occasionally, too, even in specimens from Mombasa, a small yellow spot, or scattered yellow scales invading the band from within, mark the position of the costal gap.

In examples from Natal and the Southern part of Cape Colony the gaps are far more frequently and more fully

indicated. The mark corresponding to the sickle is not bent in a curve but at a right angle.

Meriones and *antinorii*, with non-mimetic females resembling the males (also accompanied by mimetic females in the case of *antinorii*), are certainly ancestral as compared with other forms of the group, and therefore it is almost equally certain that the interrupted black submarginal band of the male is ancestral as compared with the continuous band.

The submarginal bands of the 6 males of the 1902 synepigonic group may be briefly compared as follows:—

Specimen 1.—Costal gap distinctly indicated, but closed by a broad sickle. Inner gap indicated by narrowing of band.

Specimen 2.—Costal gap closed by a narrow sickle. Inner gap as in 1, but slightly less narrow.

Specimen 3.—Costal gap open: inner much narrowed.

Specimen 4.—Costal gap closed by a narrow sickle: inner still more narrowed than in 3.

Specimen 5.—Costal gap indicated only by a slight narrowing (less marked than in any other specimen). Inner gap open, with faint traces of narrow band.

Specimen 6.—Costal gap closed by a narrow sickle: inner open, with a small detached spot midway between the nervules which form its boundaries. This specimen is much dwarfed, and it is possible that the marked discontinuity of the band may be due to reversion, brought about by the shock of abnormal conditions.

The appearance of the band in the male parent is clearly indicated in Plate XXXI, Fig. 2. The costal gap is closed by a sickle intermediate in breadth between those of the above-described specimens 1 and 4. The inner gap, only preserved on the left side, is more freely open than in any of the offspring.

The male parent (see Plate XXXI, Fig. 2) is, I believe, somewhat less heavily marked in this respect than is usual in the Southern form of *P. cenea*, and the offspring are upon the whole also less heavily marked. At the same time, they exhibit very interesting individual variations, never quite reaching the open condition of the inner gap in the parent, but in half of the examples going beyond their parent in the degree of development of the costal gap.

The evident hereditary tendencies displayed in these males, together with their marked individual differences, are of especial importance in relation to the study of the wonderful series of modifications which are encountered when we trace the allied forms of this remarkable *Papilio* from the coast of British East Africa, westward into Uganda, and north-westward into Abyssinia. In any such investigation we must reckon with the fact that individuals of the same synepigonic group are now proved to exhibit great variation in the degree of continuity of the most prominent feature in the hind-wing. E. B. P.

III. *The Synepigonic Group bred in* 1903 *from a captured female of* PAPILIO CENEA (TROPHONIUS *form of female*).

I succeeded in capturing one of these rare forms of the female in the neighbourhood of Durban on September 18, 1903. Both wings on the right side were slightly but distinctly smaller than those on the left (see Plate XXXI, Fig. 9). From this butterfly only seven eggs were obtained, and only five larvæ successfully reared. It is certain that the experiment was not in any way vitiated by the introduction of wild eggs, larvæ, or pupæ. Two of the larvæ pupated on October 19, one on October 20, and two on October 23. The butterflies emerged on the following dates:—

Nov. 2. 1 ♀ *cenea*-form (Plate XXXI, Fig. 10).
„ 3. 1 ♂ (Fig. 14).
„ 4. 1 ♂ („ 13).
„ 6. 1 ♂ („ 12).
1 ♀ *cenea*-form (Fig. 11).

Thus both the female offspring of the rare *trophonius* form were examples of the commonest of all Natal varieties.

Comparison of the Individuals of the 1903 *Synepigonic Group of* PAPILIO CENEA. By E. B. POULTON.

The first of the females to emerge is rather smaller than the other (Plate XXXI, Fig. 10). Spot (1) is unusually small for an insect of this size (compare Figs. 3, 4, and 11), being not only greatly reduced by encroachment of the ground-colour but also overspread with scattered dark scales. The specimen is a white-spotted variety very similar to female II. of the 1902 group. The appearance of spot (5) is, however, the same as in female III.

The second female is represented on Plate XXXI, Fig. 11. It is seen that the left hind-wing is somewhat crippled. The specimen is a typical white-spotted form of *cenea*, similar to female I. of the 1902 group, but having an even smaller development of the buff tint on the inner marginal border of spot (1).

It is unnecessary to describe the three male offspring in detail; inasmuch as the form of the band and the development of the gaps are clearly shown in Plate XXXI, Figs. 12–14. It is obvious, on a glance at the figures, that the inner gap is open in two specimens (Figs. 13 and 14), and only interrupted by a faint imperfect band in the third (Fig. 12). The costal gap, although not entirely open in any specimen, is strongly indicated in all three.

The condition of the band in the males of these two groups raises the question, which was previously suggested (see pp. 681, 682) by the dwarfed female represented in Fig. 6, as to whether any of the conditions associated with breeding from the egg in confinement may not favour reversion towards the more ancestral form of *meriones* and *merope*. It must be repeated that this is but a conjecture which would require the examination of a longer series of captured specimens and a far larger number of bred specimens in order to confirm it. It is, however, suggested as a possibility in certain cases by a study of the limited amount of material at my disposal.

The proportion of the various forms of the female in these two groups of offspring (1902 and 1903), and especially the absence of *trophonius* from both, raises an interesting question as to their proportion in nature. Existing records do not enable us to arrive at certain or exact conclusions, but the following data are sufficiently in agreement to justify a rough estimate.

Mr. G. F. Leigh informs me that in a good season in the neighbourhood of Durban, from 25 to 30 males might be met with in a single day; but some of these would be the same insect encountered more than once. During the last season (1903) Mr. Leigh did not see more than 30 females altogether, and of these 2 were the *trophonius* form. Inquiring the experiences of others in the same period of time, he heard of only one other specimen of the latter variety.

Mr. G. F. Leigh recognizes a second form of *hippocoonoides* with "chalky-white" markings similar to, and, as

he thinks, mimetic of *Euralia wahlbergi*. This Mr. Leigh describes as rarest of all the forms of *cenea*. It has been already pointed out that in certain respects the *hippocoonoides* form of *cenea*, and the *hippocoon* form of the Western *merope* respectively, resemble their Nymphaline co-mimics *Euralia wahlbergi* and *E. anthedon* far more closely than the primary models *Amauris dominicanus* and *A. niavius* (Trans. Ent. Soc. Lond., 1902, p. 486, *footnote*). The existence of this chalky-white form indicates an interesting approach towards the co-mimic in another character.

Mr. Guy A. K. Marshall, in sending an estimate of the proportionate occurrence of the three chief forms of the female *cenea* in Natal, warns me that he is only giving a very general impression based on a limited and now long-past experience. His estimate is as follows:—

Cenea	10
Hippocoonoides	4
Trophonius	1
	15

Mr. Roland Trimen, F.R.S., wrote as follows:—

"November 23, 1903.

"At Knysna (where I was out in the district almost every day for about eight months) I saw only 2 *trophonius*, both of which I captured. In Natal, I saw no *trophonius* during four months of almost daily collecting; I have received at long intervals 3 examples from there—1 taken *in copulâ*. I also received from Plettenberg Bay (Knysna District) 3 examples, 1 from East London, and 1 (a variety with fulvous instead of white sub-apical bar to fore-wing) from Bathurst;—all in Cape Colony. *Hippocoonoides* I never saw in the Knysna District, but have received 2; in Natal I saw and took 2 only, but have received 4 from there. *Cenea*, on the contrary, under one or other of its two forms was pretty frequent, but not nearly so much so as the male—owing to less active habits, no doubt."

"December 28, 1903.

"As regards the proportionate numbers of the forms of ♀ *P. cenea*, in say 100 specimens. I can only make a ROUGH GUESS as follows:—

Cenea (true)	50
„ (white-spotted)	40
Grades between *cenea* (white-spotted) and *hippocoonoides*	4
Hippocoonoides	2
Grades between *hippocoonoides* and *trophonius* . .	3
Trophonius	1
	100

"In this matter the preponderance of *cenea* proper in its two forms is to be expected, because its model *Am. echeria* in two forms is practically the only *Amauris* found in *South* Africa—neither *A. dominicanus* nor *A. ochlea* being at all prevalent even on the Natal coast, and not extending further South. But the rarity of *trophonius* is not easy to account for, if *D. chrysippus* is its model; the latter being numerous and generally distributed. It seems possible that *trophonius* was originally modified in mimicry of *Aletis helcita* in *West* Africa (the Abyssinian extremely rare *ruspinæ* ♀ of *Pap. antinorii* lends support to this view); but, curiously enough, *trophonius* appears to be decidedly rare on the W. Coast as well as in other parts of Equatorial Africa, where *Aletis* is abundant. A single very fine *trophonius* was in Hobley's E. African collection; it was of the *West* African character, but in several marked features much more like *D. chrysippus* than like *Aletis helcita*."

"March 19, 1904.

"It is most difficult to believe that such close mimickers as the second and third females of *antinorii*, the *planemoïdes* female of *merope*, or even (in a less degree) the *trophonius* female of *cenea*, can be as rare as they seem to be. Such admirable mimickers *ought* to be no rarer than the *hippocoon* female of *merope*, or the *cenea* female of *cenea*. It must be remembered that all the females of the group in continental Africa *seem* to be much rarer than the males, yet in the few cases of breeding *P. cenea*—on a very limited scale—there seems to have been no marked disparity in the number of the sexes." *

Mr. Trimen has kindly contributed an Appendix (see p. 691), setting forth the characters and arrangement of this interesting and puzzling group of Papilios. E. B. P.

* See p. 678.

IV. *The Synepigonic Group bred in* 1904 *from a captured female of* HYPOLIMNAS MISIPPUS *intermediate between the type form and the var.* INARIA.

The parent (Plate XXXII, Fig. 1), captured near Durban on January 2, 1904, possesses the white sub-apical bar of

No.	Date of Pupation.	Date of Emergence.	Variety.
1	——— 1904	Feb. 2, 1904	♀ *misippus* (Plate XXXII, Fig. 2).
2	——— ,,	Feb. 2, ,,	♂ smallest male (Fig. 8).
3	Jan. 28, ,,	Feb. 3, ,,	♂ largest male (Fig. 7).
4	Jan. 27, ,,	Feb. 3, ,,	♀ *misippus*, sub-apical white bar of fore-wing similar to that of No. 1.
5	——— ,,	Feb. 4, ,,	♂
6	Jan. 28, ,,	Feb. 4, ,,	♀ *misippus*, sub-apical white bar of fore-wing similar to that of No. 14.
7	——— ,,	Feb. 4, ,,	♂
8	——— ,,	Feb. 4, ,,	♀ like parent, but white bar obscured by brown scales (Fig. 3).
9	——— ,,	Feb. 4, ,,	♀ *inaria*, with bar unusually distinct but brown (Fig. 5).
10	——— ,,	Feb. 5, ,,	♀ *inaria*, similar to No. 12.
11	——— ,,	Feb. 5, ,,	♂
12	Jan. 30, ,,	Feb. 5, ,,	♀ *inaria* (Fig. 6).
13	——— ,,	Feb. 5, ,,	♂
14	Feb. 2, ,,	Feb. 8, ,,	♀ *misippus* (Fig. 4).
15	——— ,,	Feb. 8, ,,	♂
16	——— ,,	Feb. 11, ,,	♂

misippus, although the partial replacement of the black ground-colour of the apex of the fore-wing approaches the

condition found in *inaria*. It is a well-known but not very common variety, of which there are several examples in the Hope Department. Forty-one eggs were laid by this female, and the larvæ hatched on January 9 and 10. They proved to be difficult to rear during the smaller stages, when the larvæ were often buried in the moist fæces produced by the extremely succulent food-plant. The surviving larvæ were however quite healthy, and the imagines with few exceptions of the normal size. The results of the experiment are shown on preceding page in a tabular form.

Comparison of the Individuals of the 1904 *Synepigonic Group of* Hypolimnas misippus. By E. B. Poulton.

Only a single female out of eight resembled the parent, and even this was a less-pronounced variety. Of the rest, four were typical *misippus*, three typical *inaria*—one of the latter indicating some slight approach in the direction of the parent.

Thus a tendency is revealed which if general must lead to a gradual reduction in the numbers of the intermediate varieties, and an increasingly abrupt break between the *misippus* and *inaria* forms of female. In this instance the intermediate variety had little power to impress its own form on the next generation; for seven out of eight of its female offspring broke up into the two well-known and sharply-separated forms. Although the transition between *misippus* and *inaria* is far more complete than between its models *chrysippus* and *dorippus* (=*klugii*), in correspondence with the fact that a combination of mimetic forms *must* be younger than their models (Trans. Ent. Soc. Lond., 1902, pp. 482–4), the mimic has nevertheless made a considerable advance towards the abruptly-dimorphic condition of the Danaine butterfly which it resembles.

It is unnecessary to describe the male offspring which were entirely normal in appearance, and as a rule in size. The largest and smallest specimens are represented on Plate XXXII, Figs. 7 and 8. E. B. P.

Appendix by Roland Trimen, F.R.S.

The *Merope*-group of the Genus *Papilio*.

A

♂ and ♀ alike in colouring and marking, and both with the hind-wings tailed.

1. *Papilio humbloti*, Oberth.

Both sexes with a well-developed black costal border in the fore-wings terminally truncate at about ⅔ of length of discoidal cell; but in ♀ this border is more or less broadened, and diffusedly expanded to its termination.

[This species is further distinguished from all others in the group by both sexes having on the upper-side the black band of the hind-wings *hind-marginal*, like the black border of the fore-wings.]

Hab. Comoro Islands.

2. *Papilio meriones*, Feld.

♂ with a variable but always much thinner (and brownish-tinged) costal edging in the fore-wings than is shown by *P. humbloti*; ♀ also variable in this character—which is, however, always as well developed as in ♀ *P. humbloti*, and sometimes considerably broader.

Hab. Madagascar.

B

♂ and one form of ♀ as in Section A; but also two other forms of ♀ totally unlike ♂, and (except in retaining the tails of the hind-wings) closely mimetic respectively of *Amauris* and of *Danais* (and *Aletis*).

3. *Papilio antinorii*, Oberth.

I have not seen any figure or proper description of the ♂, but from Oberthür's brief mention in his account of Antinori's collection, I gather that this sex has less black about it than any other ♂ of the group.

From the figures of the ordinary ♀ respectively given by Oberthür and Haase, there must be even more variation in the size of the costal black border in the fore-wings than is shown either by *P. humbloti* ♀ or by *P. meriones* ♀,—Oberthür's figure making this feature very narrow indeed, while Haase's figure represents it as forming terminally a very broad oblique bar extending very nearly to the origins of the 2nd and 3rd branches of the median nervure.

♀, 2nd form, *niavioides*, Kheil.
♀, 3rd form, *ruspinæ*, Kheil.
} Only one example recorded of each of these forms!

Hab. Abyssinia.

C

♂ retaining same form, colouring, and pattern as in Sections A and B; but polymorphic ♀ presenting four forms (with various intermediate grades), all unlike ♂, all without tails on the hind-wings, and (with the apparent exceptions of the form *dionysos* and another which are least divergent from the ♂) closely mimetic respectively of *Amauris*, *Danais* (?also *Aletis*), and *Planema*.

4. *Papilio merope*, Cram.

♀, 1st form (nearest known to ♂, but rare), *dionysos*, Doubl.
♀, 2nd form (prevalent generally), *hippocoon*, Fab.
♀, 3rd form (rare), *trophonius*, Westw., variation.
♀, 4th form (very rare), *planemoïdes*, Trim.

Hab. Western, Central and Eastern Tropical Africa.

5. *Papilio cenea*, Stoll.

♀, 1st form (nearest known to ♂), unnamed.
[Only example known to me is from "Zanzibar," in the Hope Collection.]
♀, 2nd form (not common), *hippocoonoides*, Haase (=*tibullus*, ♀, Kirby).
♀, 3rd form (rare), *trophonius*, Westw.
♀, 4th form (prevalent), *cenea*, Stoll.

Hab. Eastern South-Tropical and Southern Extra-Tropical Africa.

R. TRIMEN.

17/iii/1904.

Note.—I have not followed Aurivillius (*Rhop. Æthiop.*, 1899, p. 464) in associating with this group *Pap. nobilis*, Rogenh. On examination of specimens of both sexes of this species—kindly lent to me by Dr. Jordan of the Tring Museum—it is perfectly clear that, notwithstanding the general superficial resemblance borne by *P. nobilis* to the more primitive forms of the *Merope*-group, it differs too widely from the latter, alike in structure, colouring, and system of markings, to be placed with them. The butterfly exhibits, however, so many features in common with those of the *Hesperus*-group, that, if not included in this group, it should constitute a separate one in the immediate proximity.

Explanation of Plate XXXI.

All the figures are represented slightly more than half the natural size.

Two Synepigonic Groups of *Papilio cenea* together with their parents—a *cenea* form and a *trophonius* form respectively.

Fig. 1. The female parent of the 1902 group, captured *in copulâ* with the male represented in Fig. 2. The butterfly represented in Fig. 1 is a typical white-spotted Natal *cenea* form. A selection of the female offspring is shown in Figs. 3–8.

2. The male parent. The prominent black band of the hind-wing is rather less heavily marked than is usual in Southern forms. This feature was inherited by the male offspring.

3. Female offspring of the *cenea* form described as III. in this memoir. A white-spotted Natal form showing some transition towards the buff-spotted variety.

4. Female offspring of the *cenea* form, described as V. Rather more transitional towards the buff-spotted form than III.

5. Dwarfed female offspring of the *cenea* form, described as IV. Intermediate between the females represented in Figs. 3 and 4.

6. Much-dwarfed female offspring of the *cenea* form, described as VI. The specimen represented is nearest to the typical buff-spotted Southern form of female *cenea*.

7 & 8. Two female offspring of the *hippocoonoides* form. Both typical except for their stunted size, especially marked in Fig. 7.

9. The female parent of the 1903 Synepigonic group captured near Durban on Sept. 18, 1903. It is seen to be a typical *trophonius* form. From this female seven eggs were obtained, yielding the five imagines represented in Figs. 10–14.

10. Female offspring of the *cenea* form: a white-spotted variety similar to the female described as II. in the 1902 family. The chief spot (1) of the fore-wing is unusually small.

11. Female offspring of the *cenea* form: a typical white-spotted variety similar to I. of the 1902 family.

12–14. The male offspring.

Explanation of Plate XXXII.

All the figures are represented nearly $\frac{1}{3}$ of the natural size.

A variety of *Hypolimnas misippus* ♀, together with types of the offspring reared from its eggs.

Fig. 1. The parent. Captured Jan. 2, 1904, at Durban, Natal. Laid 41 eggs, from which 16 butterflies were reared. Examples of all varieties among the offspring are represented in the remaining figures of this plate.

2. Female. Form *misippus*. Emerged from the pupa Feb. 2, 1904. Another female with the sub-apical white bar of a very similar shape emerged Feb. 3, 1904 (pupated Jan. 27).

3. Female. Form intermediate between *misippus* and *inaria*, resembling parent except that the white sub-apical bar is much obscured by scattered brown scales, the difference being greater than is indicated by a comparison of figures 3 and 1. This is the only one of the offspring which resembles the parent at all closely. Emerged Feb. 4, 1904.

4. Female. Form *misippus*. Emerged Feb. 8, 1904 (pupated Feb. 2). Another female with the sub-apical white bar of a very similar shape emerged Feb. 4, 1904 (pupated Jan. 28).

5. Female. Form *inaria*. A slight approach towards the parental form is seen in the sharp and distinct outline of the sub-apical bar, which however possesses the normal brown shade of *inaria*. Emerged Feb. 4, 1904.

6. Female. Form *inaria*. Emerged Feb. 5, 1904 (pupated Jan. 30). Another similar female emerged Feb. 5, 1904.

7. Male. Emerged Feb. 3, 1904 (pupated Jan. 28). The largest of the eight male offspring.

8. Male. Emerged Feb. 2, 1904. The smallest of the eight male offspring. The six unfigured males emerged on Feb. 4 (two ; one small), Feb. 5 (two ; one of them rather small), Feb. 8, and Feb. 11.